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## EVOLUTION OF FUNCTION IN THE MAMMALIAN ORGANISM*

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The life of the mammal is a synthesis of many diverse functions. They range from the digestion of porridge to the performance of Brahms, from snoring to the niceties of mathematical analysis. Here I am concerned neither with the higher faculties of the mind nor with the lower vegetative functions of the body, but merely with that intermediate region of activity which concerns itself with the muscular movements—getting about and the like—these we share with our mammalian relations generally.

A child, for example, learns to walk. It is, so far as locomotion on its legs is concerned, capable of one kind of movement—crude, uncertain toddling. From that movement, however, quite a number of things develop, the initial ability to toddle turns unconsciously into the power either to walk or to run, and these more refined movements, when exploited by conscious intelligence, create the possibility of anything from tap dancing to tight-rope walking.

But instead of interesting ourselves in the variety and complexity of the movements into which toddling may develop, we may look the other way. We may ask: Can it not be that toddling, itself a highly complicated affair, is a development or differentiation of some much cruder form of movement, and, if so, what is that movement and is it the parent of movements other than toddling, just as toddling is the parent of tap dancing and mastery of the tight rope? By way of parenthesis the words "just as" require a caveat. We ordinarily regard the development of walking from toddling as a question of practice. Can the same be said of intra-uterine movements?

These are the questions which I wish to attack:—

(1) What is the most primitive form of movement of which the mammal is capable?

(2) Does this movement differentiate and develop into other and more complicated ones?

(3) If so, are they recognisable as the forerunners of the sorts of movement with which we are ordinarily familiar in life?

Studies of the earliest movements of which the mammal is capable have been made by a number of observers, mostly on small animals with short periods of gestation, and from several points of view.

The sheep, for example, has the advantage over small animals in that development in it is a comparatively leisurely affair and its steps are therefore easily recognisable. To quote Barron, "All the events which take place over two months in the sheep are telescoped into a single week by the rat."

The period of gestation in the sheep is 21 weeks—147 days; until the 33rd day of embryonic life, the organism is not capable of any inherent movement apart from the beating of the heart. At this age it is about the length of the thumb nail and it has taken on the general mammalian form. Its eyes are well developed, its trunk, tail, fore-legs and hind-legs are all there, though in a rudimentary way. The foetus at this age does not move except in response to a, for it, rather considerable stimulus. This stimulus is quite specific, it must be given in just the right place and the response is perfectly definite. Tap it firmly just under the eye and it will give a twist to its neck. This twist causes the head in the first place to go back, and in the second place to rotate, drawing its nose towards the point of the glass rod, or what not, with which it was tapped. Tapping no other place will elicit a movement.

Why, you may ask, is this particular point on the cheek so different from the rest of the body that a response can be elicited from it and from it alone? There is a very good reason. Here, just beneath the skin, is the end of a nerve. It is the fifth cranial nerve or, rather, a branch of it. It grows down from the brain and will ultimately supply the upper jaw and the nose with sensory fibres. This is the nerve which will impress itself on one's consciousness if one gets a spasm of toothache in the upper jaw or if one smells ammonia. It is perhaps worth noting that regionally it is the nerve which supplies the most anterior part of the body.

In case a sheep were to walk forward (the natural direction of progression) the first bit of it to run into an obstacle would be the tip of its nose, and the nerve which supplies the tip of the nose is the first sensory nerve to give a response. But by the 33rd day the fibres of the nerve have not yet reached their destination, they have only reached the point under discussion. The reason why the face must be tapped rather sharply is because the immature endings of the nerve are definitely underneath the skin and not

* Substance of a lecture delivered at the Royal Institution on May 20th. The lecture was in effect a description of a film illustrating the work of the lecturer in collaboration with Dr. D. H. Barron. Its format was dictated by that fact, especially as regards absence of documentation. Its documentation and its setting in relation to the work of other observers will be found in Dr. Barron's article "The Functional Development of some Mammalian Neuromuscular Mechanisms." (*Biol. Rev.*, **16**, 1; 1941.)

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in it. The stimulus must be transmitted through the skin to the deeper structure.

The nature of the movement is reflex, that is, it is caused by a peripheral stimulus, which is transmitted to the central nervous system, in this case, the brain, which passes thence to the motor nerve that supplies the neck muscle concerned. That the first movement should be a reflex, or even a movement which involves the nervous system, is not true of all forms of life. Seemingly there is a tendency in the higher forms for neurogenetic movement to appear earlier relatively to myogenic, until, as in the sheep, movements involving the nervous system occur as soon as, or even before, those of a purely muscular character.

So much for the very first movement. In the few days which follow, the principal alteration which occurs is an expansion of that. This expansion takes place in at least four different directions.

(1) The area of skin on the face, the stimulation of which will elicit the movement, becomes greater. Other branches of the fifth cranial nerve, the great sensory nerve of the face, develop, and as they do so the areas of skin which the nerve has reached become sensitive when stimulated and evoke the movement.

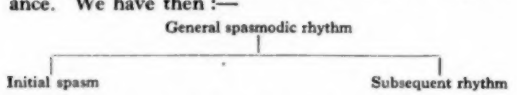
(2) The movement itself embraces an ever-increasing number of muscles, so that instead of being confined to the neck, it spreads within the next week or so to the mouth, the trunk muscles, the limbs and the tail, so that the movement amounts, not to a twitch of the neck, but to a trifling convulsion of most of the body.

(3) More than this, the response extends not merely in the number of muscles which are involved, but it also extends in respect of time. Stimulation causes not merely one spasm but a series of perhaps 20 spasms, one after the other, amounting to a rhythm.

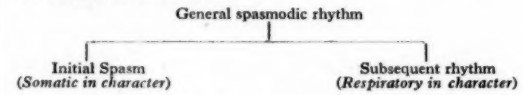
(4) A much less vigorous stimulus will suffice, as it were, to touch off the trigger of this mechanism—a drop of saline on the eye, the direction of a current of fluid into the nose or even a sharp tap on the outside of the sac within which the foetus floats in its bath of amniotic fluid.

Up to the 42nd day (approximately) the foetus has exhibited only one kind of movement, the spasm. This may have been more or less widespread, it may have been repeated more or less often, but fundamentally there was but one essential pattern.

Now, however, something quite new is seen. If the foetus be stimulated, say by a tap on the nose, a rhythm of spasms follows, but the first or first two members of the rhythm differ from the subsequent ones. In the first spasm, the head is thrown back, in the subsequent ones it nods forwards. This is the commencement of differentiation of movement—for slight as is the difference between the initial and the subsequent spasms, that difference develops into something abundantly evident and of great importance. We have then :—




To appreciate what has taken place, we have only to pass on a few days. The trifling difference between the initial and subsequent members of the rhythm is seen to denote a definite splitting of function. The initial spasm is shaping towards an indefinite body movement in which the limbs are largely represented whilst the subsequent rhythm affects principally those muscles which are ultimately concerned with respiration. The initial movement gives one the impression that the foetus is trying to do something ; though it is not at all clear what this " something " may be, the subsequent rhythm gives the impression of the foetus having been mildly out of breath as the result.




By the 48th or 49th day there is an obvious development of both the somatic and respiratory movements, though in rather different ways. The somatic movement becomes more purposeful in character, the respiratory movement becomes more regulated. Take these movements one by one.

One new element which enters into the somatic movement is gravitational response. When the foetus is lying on its side, stimulation of the nose causes a twisting of the neck and body, the effect of which is to turn the crown of the head upwards towards the sky. This reaction to gravity is different in some respects from that with which we are familiar in the mature organism. In the latter the semi-circular canals play an active part, but all observers agree that this is not so in the foetus, or rather in the foetus at 48 days ; the response is of a different nature. It is due to the unequal pressure on the two sides of the trunk and perhaps elsewhere. The side on which the foetus is lying naturally bears its weight, and it seems to be the fact that the pressure on this side is the stimulus to the gravitational response. This may not be the whole stimulus, but whether it is or not, if a piece of cardboard be placed firmly on the upper side of the body so that both sides are pressed upon, the gravitational response disappears.

As regards the limb movements : those of the fore-limbs are not symmetrical either. Both are stretched forwards as far as the knee, but whereas the uppermost fore-leg is stretched right out, all the joints being extended, with the lower fore-limb it is different ; it is flexed at the knee and the toe is pointed backwards.

The whole movement in a crude way seems to be an effort on the part of the foetus to rise from the ground, in just the way which it does shortly after birth. The hind-legs are gathered up underneath the belly of the foetus. If, then, we may stretch the word progression to include rising from the ground, we may regard the movements seen on the 48th day as containing the germ of progressive movement.

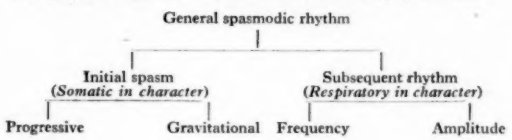
As regards the respiratory type of movement* on the 48th-49th day, two alterations are taking place.

(1) The first is that the respiratory rhythm becomes daily more easy to evoke. By the 49th day almost any muscular movement of the foetus, however trifling, will touch off a respiratory rhythm ; indeed, if at this time the observer lays the foetus in his hand it is scarcely possible to hold it sufficiently still to prevent

* It must not be supposed that these movements cause anything to go into or out of the chest at this age. The windpipe is not open, and owing to the softness of the chest wall no measurable negative intra-thoracic pressure is induced by the rhythmic movements of the diaphragm, the intercostal muscles and the throat muscles.

stray alterations of tension in the muscles from evoking some response.

(2) The second advance in the evolution of function is the gradation of the respiratory rhythm to correspond with the force of the muscular movement which preceded it. Thus, if the foetus be held very still, the respiratory responses due to adventitious movements will be relatively slow and shallow, but if the foetus be given a sharp tap so that it makes a dramatic effort, that effort is followed by a rhythm which is not only more rapid but is also more powerful. We therefore have reached the following position :—

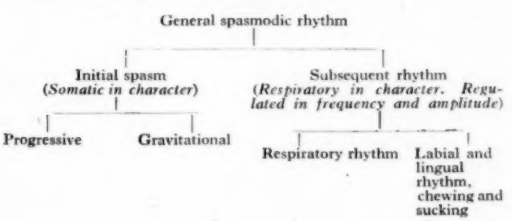



Somewhere about the 70th day, the movements of the mouth are very prominent. If an object be placed inside the buccal cavity, powerful rhythmic movements are often seen. These resemble both chewing and sucking ; it is not quite accurate at this stage to describe them as either, nor is their relation to other movements clear. In this matter, as in many others, we have been helped by the following fact : on exposure or mild asphyxiation of the foetus, its movements change ; those functions of the brain which have been developed most recently are first affected, and therefore as the foetus during the progress of this experiment deteriorates in vitality, its movements tend to resemble those which it made at an earlier stage of foetal life. A 70-day foetus as it deteriorates will tend in its type of movement shortly to behave like a 60-day foetus, then like a 50-day one, and so on.

In such deteriorating embryos, it may be seen that the rhythmic mouth movements which at 70 days appear to be quite distinct from any others, gradually merge into the general respiratory, from which they have no doubt been differentiated.

I have spoken a great deal about the fifth cranial nerve, and I would end this part of my lecture by collecting some of the points which I have stated about it. The earliest reaction which it gave me was local ; as the foetus grew, the reaction became widespread, but by the 70th day it has become strictly localised again. I emphasise this sequence because, though exhibited in its most striking form by the fifth cranial nerve, it is true of all sensory nerves, the reaction to stimulation of them being, initially, local, becoming more widespread but finally settling to a local response.

The following chart sums up, so far as we can go here, the information at our disposal about the differentiation of actions of various sorts :—




## Character of Movement

Hitherto I have spoken of the evolution of a number of actions, if I may describe them by that term, breathing, chewing, getting up and the like. But any of these actions may change in character ; it may be rapid, jerky and spasmodic, or it may be drawn out and gradual, or, again, it may even be a sustained movement in which there is an actual static phase, such as the Nazi salute. The evolution of the actions which I have described has all concerned itself with those parts of the central nervous system into which sensory nerves enter and from which motor nerves leave—the hindermost part of the brain (the medulla) and the spinal cord. In general, the organisation of action takes place from above downwards, and it is initiated at the point of entry of the nerve which receives sensations from the face and nose and is modified later by influences entering the spinal cord from the arms, the trunk and the legs. But if in the central nervous system this evolution of function takes place from the point of entry of the facial nerve backwards, it takes place in a different sense from that same point progressively forwards. The forward development is concerned less with what the foetus does than with how he does it.

The first movement of all was a simple twitch or a minute spasm ; when later it became necessary to expand this twitch into something which stretched over a longer time, the expansion consisted of the extension of a single twitch into a series of twitches—a rhythm, but the character of each individual jerk of which the rhythm consisted was unaltered ; even when differentiation commenced the twitches were still twitches.

Between the 45th and 50th days, however, the movements gradually assume a different character, namely, they take on an air of deliberation ; if the arm is thrust out, the movement is less that of the boxer getting in his punch than that of the constable raising his hand to stop the traffic.

Just as the jerky movements obtained from the lower parts of the central nervous system gradually took on a certain appearance of purposefulness and became evidently the forerunners of the types of movement which we actually recognise, so these sustained movements also tend to fall into certain patterns which we recognise as postural. In association with the turning of the neck to which I have already alluded, there are harnessed the corresponding movements of the legs, that is, the fore-leg on the side to which the nose is turned is extended, whilst the other fore-leg tends to be flexed or partially so. At a later date, characteristic postural movements of the hind-legs, the trunk and the eyes are associated with this twisting of the neck. Indeed, it is only necessary to take the head between one's fingers and rotate the neck alternately in one direction and then in the other to produce this corresponding marionette-like movement of the eyes and limbs.

These postural movements are essentially those described by Magnus and de Klejn ; the difference between their demonstration of the movements on the adult animal and our own on the foetus is that they, in order to secure the movements, had to perform a surgical operation in which the mid-brain was relieved of the influence which dominated it, notably the semi-circular canals. In the case of the 55-day sheep's foetus, no such surgical operation is

necessary because what Magnus and de Klejn cut away has not at this age functionally developed. The alteration from the simple jerky type of movement to the more deliberate postural type is attributable to this development of the mid-brain and its influence on the centres below it.

The initial phase of postural movement soon disappears; by the 60th day, if the foetus be delivered, it exhibits a different picture, the forelegs are tensely stretched out side by side, the head and the tail are extended, and the foetus presents the appearance of an animal suffering from what is known as "decerebrate rigidity"—a condition which, again, can only be obtained in the adult by a surgical operation, that of severing the foremost parts of the brain from parts behind them, and so ridding these latter from the influence of the higher centres. But, once more, in the case of the 60-day foetus, no surgical operation is necessary for the simple reason that the higher centres in question have not developed physiologically—function has developed upwards far enough, but only far enough to produce this rigidity.

The picture of rigidity does not last many days. From about the 50th day onwards a characteristic has been gradually creeping into the picture, slight at first, but quite evident; by the 70th day it becomes dominant, namely, "inhibition." During the eighth and ninth weeks, this growing inhibition amounts to no more than a certain evident restriction of movement associated with the postural patterns which I have described. On the 70th day, however, if the foetus be delivered, so far from exhibiting spasmodical or postural movements, it gives the impression of being dead or at all events soundly asleep. If mechanically stimulated, the stimulus must be strong if it is to be effective, and even at that the response is only very restricted. This suppression of movement means that function has progressed well up into the fore brain. That motility has not been abolished but only suppressed is easily proved. It is only necessary to leave the foetus exposed for a while or to pinch the umbilical cord in order to uncover the functions which I have tried to describe. A more elegant proof is furnished by intra-uterine transection of the central nervous system. It is possible to cut across the brain or cord at any given point, between the 50th and 70th days, without impairing the growth of the foetus. If, at 70 days, the section consists in mere severance of the cerebral hemispheres from the rest of the central nervous system, no change in the behaviour of the foetus can be seen, but if the section is lower down—about the middle of the fore brain—the lower parts are freed from "inhibition" and the foetus exhibits the "rigidity" pattern of 60 days. If the section is just below the "pons Varolii," the foetus exhibits almost unceasing jerky movements, which are both somatic and respiratory and are strongly reminiscent of a foetus of about 45 days. At 70 days, however, the foetus appears to be in a sound sleep and in this sleep we may leave it.

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Intimation has been received that full-time slaughtermen whose age of reservation was raised from 25 to 30 at October 31st, are to continue to be reserved at 25, until December 31st, and thereafter they will be reserved at 30 until further notice. This means that slaughtermen will after the end of this year be reserved at the same age as "butchers and cutters."—*Meat Trades Journal.*

## Remarks on the Physiology of the Nervous System * †

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It is obviously impossible to cover all phases of the physiology of the nervous system in the time available here, so I must limit my discussions to certain parts. I hope the topics that I have selected for consideration will have practical importance for some of you and will at least be of interest to all.

The nervous system is of greater practical importance than the time devoted to it in most of our veterinary colleges would suggest. Particularly, it seems to me, has there been a tendency to slight the physiology of the nervous system. This is perhaps largely the fault of the physiologists themselves. In fact, the whole field of veterinary neurology—anatomical, physiological, pathological, clinical—is inadequately developed. There are some hopeful signs, however. For instance, I note with interest that this association has a Committee on Neurology which will make a report at this meeting.

Much of the fundamental research work on the physiology of the nervous system has been carried out on the dog and cat and a great fund of information is available for these species. However, comparatively little has been done on the *clinical* physiology of the nervous system in these animals. This is one of the directions that research work must take if we are to have an adequate understanding of the functions of the nervous system as altered by disease in these species. It is evident that much of this work will have to be done by, or under the sponsorship of, our veterinary institutions. We can hardly expect other agencies to undertake extensive studies in the clinical physiology of the nervous system of animals.

The nervous structures of the body may be conveniently divided into the central nervous system, which comprises the brain and spinal cord, and the peripheral nervous system, which includes the cranial and spinal nerves, their ganglia and end-organs, and the autonomic nervous system.

The central nervous system is so complex physiologically that in order to analyse its functions adequately one has to resort to experimental simplification, thereby reducing the total amount of nervous tissue in which reactions will occur. This can be accomplished either by surgical removal or separation of parts of the central nervous system, or by restricting the conditions of stimulation so that response will be elicited in only a part of the nervous system.

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* Presented at the eighth annual meeting of the American Animal Hospital Association, Buffalo, N.Y., April 23rd, 1941.

Much of the material in this paper is based on the writings and work of Bard. See "Macleod's Physiology in Modern Medicine," edited by Philip Bard, Ed. 8, 1938, for a summary of this work and references to the literature. Other references are: Fulton, "Physiology of the Nervous System," 1938, and Dukes, "The Physiology of Domestic Animals," Ed. 4, 1937.

† Reproduced from *The North American Veterinarian*, 1941, August, pp. 473-476.

## Levels of Functional Organisation in the Central Nervous System

By experimental transections of the central nervous system at various levels, much can be revealed about functional organisation in the nervous system. When a lower portion of the nervous system is separated from a more anterior part, one is able to observe: (*a*) the independent activities ordinarily carried on by the part of the nervous system below the transection; (*b*) the functional losses, or deficiency phenomena, in this part; and (*c*) certain excessive activities, or release phenomena, commonly held in check by the activity of parts of the nervous system above the transection. This last conception, that certain lower, more primitive levels of the nervous system are normally held in check by higher, more recently acquired levels, has been a very fruitful one in neurophysiology. According to this idea, one of the chief functions of the upper levels of the nervous system is to hold in check, restrain, or exert an inhibitory effect over, the lower levels. When this influence is removed, we are able to observe certain release phenomena.

*The Spinal Animal.*—A spinal mammal may be prepared by transection of the spinal cord at one of the upper cervical segments. Since in such a preparation the respiratory centre is separated from the respiratory muscles, it is necessary to use artificial respiration if life is to be maintained. Such a preparation remains useful for study only a few hours. For longer observations on the spinal mammal, the so-called chronic or survival preparation must be used. The transection of the central nervous system in this case is made below the fifth cervical segment, thus leaving the phrenic nerves connected with the respiratory centre. Spontaneous breathing movements will continue.

Immediately after the operation of spinal transection, a condition of severe depression of most of the reflex activity of the spinal cord comes on. This is known as spinal shock. Some of the deficiency phenomena seen in spinal shock are temporary, whereas others are of an enduring nature. In mammals the symptoms are much more severe than in lower vertebrates. In the dog and cat, in which species the condition has been extensively studied, there is a permanent inability to maintain a normal body temperature even when the temperature of the environment is only slightly altered, and a permanent loss of ability to shift the position of the body as a whole or to make any voluntary movements. The latter deficiencies favour the development of cutaneous ulcers. At first, blood pressure is low but if the animal survives, the blood pressure gradually returns to normal.

Spinal dogs and cats, properly prepared and adequately cared for, may live for weeks or months. Many reflex activities of the spinal cord, suppressed during spinal shock, return after some days. Some of these are somatic reflexes involving skeletal muscles, whereas others are visceral reflexes involving smooth muscle and glands. Among the somatic responses obtainable from the spinal animal are: the flexor reflex, crossed extensor reflex, knee jerk, scratch reflex, extensor thrust, stepping reflex and, for short periods of time, even a standing posture, provided the limbs are passively placed in correct position.

A number of visceral responses are seen in the spinal animal. In time, the bladder is able to empty itself reflexly and after some weeks automatic emptying of the rectum occurs. Engorgement and secretion in the vagina and erection of the penis and ejaculation in the male are observed. The spinal bitch may become pregnant and bear a normal litter of puppies. In fact, impregnation has been observed in the bitch after complete removal of the spinal cord. Vasomotor reflexes eventually return and blood pressure is then well maintained.

*The Decerebrate Animal.*—The cerebrum includes the midbrain, interbrain, and the two large masses of nervous tissue known as the cerebral hemispheres. If the brain-stem is transected through the lower part of the midbrain, a decerebrate preparation results. Such an animal is capable of more complex responses than the spinal animal. Immediately after decerebration, many reflexes may be obtained. There is no period of depressed activity corresponding to spinal shock. Particularly active in the decerebrate preparation are all *extensor* reflexes—so much so, in fact, that without any external stimulation the extensor muscles go into strong contraction. This condition is known as decerebrate rigidity. It is characterised by hypertonus of the extensor muscles, and a condition of exaggerated standing results. In survival experiments the rigidity may persist for weeks. Although capable of giving more complex somatic responses than the spinal animal, the decerebrate animal is nevertheless unable to return to a standing posture if pushed over, nor can it walk, run or jump. These complicated responses are mediated by nervous mechanisms situated farther forward in the brain-stem than the level of transection for the production of decerebrate rigidity. Some degree of anger may be shown by the decerebrate animal upon the application of stimuli that in the normal animal would evoke pain. However, effective attempts at escape or attack are not made. Cardiovascular reflexes are quite active in the decerebrate preparation, but heat regulation is almost entirely absent. Panting and shivering do not occur. The decerebrate animal is capable of swallowing, vomiting, and carrying on respiratory movements.

Decerebrate rigidity is looked upon as a release phenomenon. The vestibular nuclei in the medulla oblongata are essential for decerebrate rigidity and it is believed that their activity is normally inhibited, or held in check, by nerve impulses coming from locations higher up in the central nervous system.

*The Decorticate Animal.*—The cerebral cortex, or pallium, is acquired late in vertebrate evolution. It is concerned with those nervous reactions that result in consciousness. It is the seat of the highest type of nervous reaction termed association. Whereas the spinal cord and brain-stem mediate the inborn nervous reactions often termed "unconditioned" reflexes, the cerebral cortex mediates the individually acquired nervous reactions often termed "conditioned" reflexes. The cortex, especially that of man, is characterised by a high degree of educability. When removal of cerebral tissue is limited to the cortex, the resulting deficiencies are far less severe than those produced by transection through the midbrain.

A striking deficiency in the decorticate animal is the enduring loss of responses dependent upon the past experiences of the individual and the inability to learn anything new. Equally striking is the fact that the decorticate mammal (dog or cat) can walk, sit, crouch, run, and keep right side up. The first

successful decortication of a mammal was accomplished by Goltz, in 1892. Decortication was achieved in three successive operations. The dog lived for more than 18 months after the last operation and was then killed so that its nervous system could be examined. A few days after the last operation, the ability to walk returned, and after a time normal locomotion was possible. The animal walked restlessly most of the day but slept at night. A loud sound would awaken it. Hunger was evident and the dog would eat, but only when food was brought close to its nose. Digestion was good, but the nutritive condition of the animal was only fair. The sense of touch was impaired though not abolished. Painful stimuli evoked movements, barking and snapping. There was evidence that the sense of taste remained, but the sense of smell was abolished. The sense of hearing was dulled. Vision was profoundly affected, for obstacles were run into; but complete blindness could not have been present, for strong light caused the animal to close the eyes and turn the head away. The pupillary reflexes remained. The psychic functions were greatly reduced. Persons or other dogs were not recognised. Memory and ability to learn were gone. The dog had been reduced to the condition of an automaton, a reflex machine. Its individuality was gone. More recent studies on the decorticate cat and dog have greatly extended our knowledge of the capacities of the upper portions of the brain-stem in these species.

Whereas the decerebrate animal is essentially unable to regulate its body temperature, the decorticate animal possesses a high degree of heat regulation. In the decorticate cat, thermal regulation is essentially normal. In the decorticate dog, it is interfered with at high environmental temperatures by inability to pant. The chief central mechanism for the regulation of body temperature is located in that part of the interbrain designated as the hypothalamus. Nevertheless, heat regulation comes to some extent under the influence of the cerebral cortex. The central mechanisms for heat regulation exert their effects through both the somatic and the autonomic divisions of the nervous system.

The decorticate animal not only regulates its body temperature well but at times displays the primitive emotions of anger, fear, and sexual excitement. Even when subjected to trifling stimulation or irritation, decorticate cats and dogs may show typical rage responses. Cats lower the head, arch the back, retract the ears, lash the tail, hiss, growl, strike, and show erection of hair, pupillary dilatation, widening of the palpebral spaces, retraction of the nictitating membranes, cardiac acceleration, and sometimes sweating from the foot pads. Gentle insertion of the rectal thermometer in decorticate dogs may cause growling, baring of the teeth, and struggling combined with snapping and biting. These rage responses of the decorticate animal are poorly directed as compared with those of normal animals and there is no effort to escape or move away during the stimulation. Proper direction of the rage response and efforts to escape from the source of irritation are cortical functions.

Fear can be exhibited by the decorticate cat and dog but the exact subcortical source of this response is not known.

Of more than passing interest is the observation that decorticate mammals are capable of showing signs of sexual excitement. To quote from Bard, who has extensively studied the capacities of decorticate mammals :—

> It has been demonstrated that in several species of mammals the full pattern of mating behaviour can be elicited after removal of all cerebral cortex. When under the influence of ovarian hormones, wholly decorticate female cats, rabbits, and guinea-pigs exhibit typical oestrual behaviour. After removal of all cortex, male rabbits are able to execute effective copulatory behaviour. These patterns of sexual response must therefore be elaborated by subcortical mechanisms. There can be no doubt, however, that in any mammal the presence of the cerebral cortex greatly increases the number of circumstances which are able to modify the occurrence of sexual behaviour. Evidence is lacking to show that the striatum plays a part in the control of sexual behaviour and certain experimental results appear to exclude the possibility that the greater part of the thalamus is concerned in any essential way with oestrual behaviour.

As to the part played by the hypothalamus in the central regulation of sexual behaviour, no exact statement can as yet be made.

There is evidence to show that reactions of pleasure are sometimes seen in decorticate cats. Purring and other manifestations of pleasure have been observed in such animals. Electrical stimulation of the hypothalamus may cause purring. It is pointed out by Bard, however, that "purring in cats is not always a sign of pleasure or contentment. As a matter of fact it is not uncommon to hear it in animals which are agitated or restless. Only when purring is accompanied by postures and movements which suggest pleasure can it be regarded as a mode of expressing enjoyment or satisfaction."

### The Cerebellum

The cerebellum, like the cerebrum, is a part of the suprasegmental apparatus in contrast with the more primitive segmental apparatus or brain-stem. The cerebellum develops from the region of termination of the vestibular nerves in the medulla.

In an effort to solve the problem of cerebellar function, investigation has proceeded along two main lines: extirpation or surgical removal and electrical stimulation. The former method has been more extensively used and has yielded the best results.

The effects of decerebellation are entirely of motor origin. All investigators agree that consciousness and sensory phenomena are in no way affected. The motor disturbance expresses itself chiefly in the form of tremor; dysmetria, or inability to judge distance in the execution of motor acts; asynergia, or lack of ability to co-ordinate or synergise the activity of muscles producing complex movements; and ataxia. All workers agree that cerebellar control of skeletal muscles is ipsilateral, that is, each half of the cerebellum controls the muscles on the same side of the body. This is indicated by experiments in which unilateral decerebellation is performed.

The dog without cerebellum stands as if on stilts. The back is convex instead of straight or slightly concave. The legs are overextended and overabducted, so as to furnish a wider base of support for the body. This peculiar attitude is one of the most characteristic signs of decerebellation. In running or walking decerebellate animals tend to go forward in zigzag fashion, swinging from side to side. The decerebellate dog may live in good health for an indefinite

time. However, the disturbances of motor function indicated above are permanent.

### The Autonomic Nervous System

The nervous system includes a somatic division, concerned with the control of activity in skeletal muscles, and an autonomic division, regulating the activity of smooth muscle, cardiac muscle and gland.

The autonomic nervous system, supplying innervation to visceral muscle and glands, may be divided into a parasympathetic part and a sympathetic part. Nerve fibres making up the parasympathetic division issue from the central nervous system in the region of the brain-stem and in the sacral region. This division of the autonomic nervous system is therefore sometimes referred to as the craniosacral division. The sympathetic outflow from the central nervous system takes place in the thoracic and upper lumbar regions.

In a conversation which I had with a veterinarian the past winter, I went into some of the details which I have attempted to bring out in this short paper. I was asked then to present this material to this group. I felt rather reluctant to do so, feeling that perhaps I might offend somebody. I have tried to present the matter as briefly as possible and with the hope that I may be able to instil a little deeper feeling as to the value or the necessity of a better study of nutrition as it affects the small animals.

## ARTIFICIAL INSEMINATION OF CATTLE: OFFICIAL SCHEME SUGGESTED

An appeal that the Ministry of Agriculture should take the intiative in forming a society to operate a scheme for the artificial insemination of cattle was made by Dr. S. Bartlett, of the National Institute for Research in Dairying, Shinfield, at the 23rd annual meeting of the Berkshire Milk Recording Society. In his address Dr. Bartlett said there were certain advantages in the scheme over ordinary mating. What was needed was an official driving force, and he would like to see the Ministry of Agriculture provide that driving force, because he thought the scheme should be adopted as quickly as possible. A central society which could supply the needs of small herds would be of great use. This country could neglect the system, but he felt sure that other countries would not neglect it. After the war Europe would need stock. England was on the doorstep of Europe and ought to have the greatest advantage. If they neglected their opportunities he feared they would find themselves outside the market.

Dr. Bartlett's address was followed by an interesting discussion, and it was agreed that the committee of the society should consider what steps could be taken to initiate the system on organised lines.—*Reading Mercury.*

* * * * *

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## ESSAY-REVIEW

### The Nervous Diseases of Cattle*

The book under review represents something new in veterinary publications. Apart from a small book written by Professor Dexler, of Prague, in 1899, on the nervous diseases of the horse, no single text-book has yet been devoted solely to a systematic exposition of the disorders of the nervous system in the domesticated animals. This is a state of affairs widely different from that which prevails in human medicine, where neurology forms a major branch of specialised study, with several journals and a large number of text-books devoted to recording the advances made in this study. The first reaction of the reader of the title of this review may be one of surprise that the authors have been bold enough, in view of the relative lack of specialised attention paid to the nervous diseases of animals and the little that must consequently be known about them, to publish at this time a book on the subject. The truth is, in the first place, as the authors rightly stress, and as is very evident on reading their book, that far more is known about the nervous diseases of animals than is suspected by the uninitiated; and, in the second place, the great advances made in the study of human neurology during the last half century have been very largely derived by careful experiments in the laboratory upon animals. But far more could be soon made known, in the view of the authors, if veterinary students and practitioners were primed in the now orthodox methods of human neurology for the routine investigation of cases of nervous disorder. Hence, for this specific purpose and to make, as is their modest claim, a beginning in the systematic study of veterinary neurology, the two authors entered for some time into collaboration, the one (Frauchiger, a pupil of Veraguth, of Zürich) bringing to the task his experience as a worker in human neurology, and the other (Hofmann) his own experience as Director of the Ambulatory Clinic of the Veterinary Faculty of Berne University, where between 7,000 and 10,000 sick animals, mainly cattle, are treated annually. It is for the reason that Hofmann's own experience had been concerned mainly with cattle, and he had for some years paid special attention to their nervous disorders, that cattle were chosen for the subject of the book, though it is admitted that probably more may be actually known, in respect of some classes of nervous disorder at any rate, about the subject as it affects some of the other domesticated animals, such as the horse and dog. Parenthetically, the reviewer cannot help but be struck with a certain freshness, which probably bespeaks a familiarity with the subjects of their writings not always otherwise found, in the text-books and original articles published by the teachers of veterinary schools with large ambulatory clinics, the other book consulted which has this freshness being the last edition of Udall's "Practice of Veterinary Medicine."

* Die Nervenkrankheiten des Rindes: Eine Grundlage für eine vergleichende Neurologie von Mensch und Haustier, von Dr. med. E. Frauchiger, Dozent für vergleichende Neurologie und Dr. med. vet. W. Hofmann, ord. Prof. für Rinderheilkunde, an der Universität Bern. 361 pp. + 139 text-figs. 1941. Berne: Medizinischer Verlag Hans Huber. [Price, 24 Swiss francs.]

Part I of the book (101 pp.) under review gives a short historical sketch upon the investigations of nervous disorders of animals, the topographical anatomy of the nervous system in the ox, illustrated with several excellent figures, and the methods of clinical investigation. In some respects this is the most valuable part of the book.

Part II deals with the nervous diseases of the ox systematically, on the orthodox plan of human neurology, and attempts to relate these diseases to those well studied in the human subject and to those observed in the other domesticated animals. A large part of this information can be found in the newest editions of the larger text-books of veterinary medicine (such as Hutyra and Marek's) or of veterinary pathology (such as Joest's). The authors are fully conscious of their own limitations in embarking on this wide field. The book, as they contend, is not merely a compilation; it also bears evidence of much original observation, but this has been obviously somewhat limited in scope. The three sections of human neurology, the authors state, in which the greatest advances have been made of recent years have been in brain and nerve surgery, psychotherapy, and the study of the neurotropic viruses. So far as concern cattle, however, the most striking advances in our knowledge of nervous and neuromuscular disorders, it is contended, have (excluding the study of the neurotropic viruses, which indeed do not affect cattle so severely as some other species), been made in particular in those familiar and widespread disorders, such as milk fever, lactation (grass) tetany, transit tetany, and acetonaemia, on which illumination has been rapidly thrown through the labours of biochemists, nutritionists, and endocrinologists. In these respects, and in respect also of the degree of familiarity which the authors show with the very important field of toxicology and more especially the aspect of this study which takes under its purview the toxicology of plants poisonous to livestock and liable to cause pronounced nervous derangement, the book is weak and the information conveyed out of date. However, all this newer information can be readily woven again into the framework of this first real excursion into veterinary neurology.

With regard to the frequency of nervous disorders in cattle, no reliable figure can be given because, firstly, diagnosis of cases has commonly been faulty; secondly, veterinary aid is sought usually for only grave cases in a given cattle population; and, thirdly, the ox being an economical animal, it is not allowed to survive to the old age when many troubles of this kind become manifest in the human subject. Cattle are, fortunately, not afflicted with an infectious disease such as syphilis, which accounts for a high proportion of human cases. However, the records of the Official Veterinary Insurance Department of the Canton of Zürich for the years 1896-1932, when compensation was paid out for 143,745 head of cattle, place nervous diseases at 4 per cent., tuberculosis heading the list with 36 per cent. During the year 1938, when over 10,000 cases were treated in the Berne ambulatory clinic, 200 (2 per cent.) were classed as neurological cases, the detailed distribution of these cases being as follows: Diseases of the brain 6, spinal cord (spastic paresis, tuberculosis, etc.) 24, peripheral nervous system 1, "convulsions" 23, "tetany" 72, parturient paresis (milk fever) 30, paralysis 16, vices (nymphomania, etc.) 22, monsters 5, poisoning (arsenic) 1. The distribution of these cases gives some indication of the limitations of the authors' experience.

Of the brain diseases of cattle caused by viruses, descriptions are given of affections to which the following classification is accorded: (1) Primary, which include sporadic cases and the enzootic bovine encephalitis first described by G. Moussu in Northern France in 1906, and, later, in 1922, by other French authors, and also recorded in Sweden. The relation of this disease, which has certainly not yet been sufficiently studied, with the enzootic encephalitis of calves described in U.S.A. by Mathews, and with the disease in calves in Mexico, stated to be conveyed by ticks, described by Escalomo and Camargo, is not yet known. Further, several papers (few of which are mentioned by the authors) have appeared on the disease known as "tick paralysis" in cattle, in South Africa, Australia, and elsewhere, which seems to be a virus disease, possibly related in its aetiology to the above. (2) Secondary (that is, caused by viruses that are primarily organotropic, and secondarily neurotropic). The best example is malignant catarrh (a common and important disease in many parts of the world, though for some years it has not been described in this country), but brain symptoms may occasionally be seen in attacks of rinderpest. (3) Virus diseases affecting the brain, which are common in species, including man, other than cattle. The well known examples are rabies and pseudo-rabies (mad itch, Aujeszky's disease). The authors do not mention the interesting form of rabies conveyed by vampire bats in the West Indies, or the extensive outbreaks recorded several years ago in Brazil conveyed by mice.

Of brain diseases caused by bacterial infection, interest attaches to Christiansen's finding that 11 per cent. of cases of calf diphtheria (caused by *Fusiformis necrophorus*) show brain localisations, and Pallaske and Barboni's cases of diffuse disseminated purulent encephalitis caused by staphylococci and *Corynebacterium pyogenes*.

Brain tumours appear to be far rarer in the domesticated animals than in man. However, "gid," caused by *Coenurus cerebralis*, though not so common as in sheep, is not very rare in cattle.

Botulism, which, as the disease known in South Africa as lamziekte, has now been recorded in several other parts of the world, caused by the toxin *B. parabotulinus B*, is designated by the authors as a "bulbar paralysis." Among affections of the extrapyramidal system, mention is made for comparative reasons, of the Schweinsberger disease of horses, described by Dobberstein in 1926, and the South African *dunziekte* (Seneciosis)—a far more thorough description of this disease is given in Steyn's textbook "The Toxicology of Plants in South Africa")—which is identical with the Winton disease of New Zealand and "walking disease" of America; here, chronic liver disease is the most prominent pathological feature. No mention is made in the book of the interesting toxic conditions known as *krimpsiekte* (*Colyledon* spp., *Malva parviflora*, and *Cynanchum* spp. poisoning), and the "pushing-disease" of Natal (*Matricaria* poisoning) which might usefully have been referred to at this stage.

The authors identify, possibly wrongly, the nervous disease recorded in steers by Piot-Bey, in 1913, in Egypt with paralysis agitans (Parkinsonism) of the

human subject; from the history of these animals they appear more likely to have been cases of "transit tetany" (hypomagnesaemia).

Dealing with diseases of the spinal cord in cattle, the authors refer to the posterior spastic paresis of calves and young stock, described fully by Götze (1932), which they believe resembles the condition named as spastic spinal paralysis or amyotrophic lateral sclerosis in man. Mention is made of swayback in lambs as showing a resemblance, in the author's view, to spinal hereditary ataxy (Friedrich's disease) in the human subject, though Innes has recorded his view that the condition more closely resembles Schilder's encephalitis in the human subject: no mention is made of recent studies relating the disease to faulty copper metabolism. The relation of the myelites and neuromuscular disturbances to various vitamin deficiencies, a difficult subject which is at the present time under keen investigation, is lightly touched upon in the book.

It is now well known that there are several virus diseases among animals (Borna disease, equine encephalomyelitis, louping-ill) which, aetiologically, bear some resemblance to human anterior poliomyelitis (infantile paralysis). In 1938, one of the authors of the book under review (Frauchiger) recorded the case of a one-and-a-half year old steer in the Jura mountains, at a time when the human disease was endemic in the vicinity, which showed clinical and pathological changes identical, in the author's view, with those of the human disease. Doerr, however, has rightly stressed that the record does not prove that the human infection is transmissible to cattle, because the viruses of the two diseases have not yet been proved to be identical (p. 199). Frauchiger and Messerli have since shown that the infection in two cases of spontaneous poliomyelitis in pigs could be transmitted by artificial inoculation to an ox.

Tuberculous spondylitis, echinococcus and coenurus cysts, endothelioma, and myoma have been recorded as affecting the spinal canal and causing paralysis by compression of the spinal cord.

Of the various causes of meningitis, the common human epidemic form of cerebrospinal meningitis, caused by the meningococcus, has not yet been recorded with certainty in cattle. From the figures available, the authors calculate that about one-half per cent. only of cases of tuberculosis in the bovine animal display tuberculous lesions in the nervous system. The lesions in this disease are well described. Melanosis affecting the meninges is not a rare condition in cattle.

Among diseases affecting the peripheral nervous system in cattle, mention may be made of facial paralysis, lingual paralysis, scapular paralysis, caused by injury to the thoracic nerve, and radial paralysis, paralysis of the sciatic nerve, and paralysis of the cauda equina.

Neurofibromatosis (von Recklinghausen's disease) of the human subject occurs only in cattle among the domesticated animals.

The diseases of the autonomic (vegetative, or sympathetic) nervous system are now known mainly to be intimately related to disturbances in the endocrine secretions and represent in themselves a wide field of study in which advances in knowledge are now rapid. Related to some of these disturbances there is often a striking lowering in the mineral constituents (calcium, phosphorus, magnesium) of the blood. The subject was well treated in so far as it most particularly concerns the commonest affections of this class in the bovine animal, in the discussion opened by Dr. H. H. Green at the N.V.M.A. Congress in 1939 (see *Veterinary Record*, 1939, Sept. 30th, p. 1179.) Cases are on record of hyperthyroidism (Grave's disease) and hypothyroidism (cretinism) in cattle, though (except for the "bulldog" calf) they are rare. Dwarfism of pituitary origin has also been recorded. Apart from true tetanus, caused by the toxin of *B. tetani*, a condition which is rare in cattle as compared with the horse, though it sometimes occurred after parturition, various forms of tetany ("lactation" or "grass," and "transit") of non-bacterial origin, have during recent years received close attention through the studies of Sjollema, Green and others. The state of knowledge upon parturient paresis is now familiar to all veterinary surgeons in this country; it has been much better dealt with in recent general text-books on veterinary medicine (such as Udall's) than in the book under review. Whether true epilepsy occurs in any of the domesticated animals has been much disputed. Several reports of alleged chorea in cattle are on record. Convulsive disorders are well known to occur, as in *lamziekte*.

In a first attempt to collate the available knowledge upon the neurology of a species of domesticated animal it is obvious that the work is likely to fall short of expectations in several particulars. Veterinary readers owe a debt of gratitude to the writers of the book under review, however, for having attempted to systematise the available knowledge and shown the way to a more orderly study of this group of ailments. In one respect, considerable improvement ought to be effected, namely, in the manner of presenting references to the papers consulted in drafting the text. The format of the book and the quality of the paper used throughout must excite envy in the minds of readers dwelling in countries not so blessed as Switzerland happens to be at this moment.

J. T. E.

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### Weekly Wisdom

*". . . I have heard the most startling claims made for M & B 693, claims that I am sure would not be sustained by the makers, and I fear that even some of my colleagues have occasionally allowed their zeal to outrun their knowledge of the facts. This difficulty in assessment of the value of a new treatment is even more marked in the case of a lesser advance, in which the benefit, although probable, is debatable. One gets the impression that there is a definite swing of the pendulum; first the notorious conservatism of the British medical profession, doubting gravely as to its having any value at all, then the insistent enthusiasm of those who have tried it and found it entirely satisfactory, followed immediately by the equally insistent pessimism of those who have tried it and found it to be entirely useless, and finally the general acceptance of its proper position in the* Materia Medica, *according to the equally British faculty for compromise.*

*All this, however, leaves the general practitioner in a quandary.*—O. R. Tisdall, M.A., M.D., The General Practitioner and Scientific Thought. *J. Roy. Soc. Arts*, 1941, September 5th, p. 628.

## The "Anxiety Neuroses," with Special Reference to their Onset in Animals *

Freud's definition of anxiety as "the fear of castration" is, I think, a little narrow. I do not doubt that imminent castration might cause anxiety in many of us, but to say that anxiety is a particular form of anxiety is not very enlightening. A definition to be a definition must class the thing defined as some particular species of a wider genus. Fear of castration is a rare variety of the species anxiety. Subjectively anxiety is defined as the sensation-emotion that a person feels in the presence of difficulties with which he does not feel himself competent to cope. We can all understand this definition because it is subjective, because it is the common idiom of everyday life, but scientifically it tells us very little about anxiety. It is much more difficult to get away from our feelings and view things from outside. The best objective definition I can make is the following: the human machine maintains its precarious balance, which is its life, under the impact of its surroundings by two main reactions, first, by a behaviour that removes the stimulus, and, second, by a behaviour that removes it from the range of the stimulus. It either attacks or retreats. When the mechanism does not act as a whole in one or other of these ways there is friction within the machine itself. Some of the cells are attacking, others are retreating, each according to the habit pattern past experience has developed in them. A new situation may well contain factors that have in the past been met separately by each reaction which when acting together produce both reactions, and the result is inefficiency of the whole. One reaction may take precedence over the other and one behaviour develop, but it is not wholehearted: it acts against an active minority (sometimes a rapid alternation between the two behaviours may result in an equal ineptitude). It is this inefficiency (or alternation of behaviour) that is meant by the term "anxiety." To be or not to be, that is the anxiety. . . .

Man worries more than any of the other animals. This is due to his superior intelligence. He has, as compared with the other animals, an enormous front brain. This front brain, or cerebrum, or cerebral hemisphere, is the part that enables him to learn from experience, and the higher, that is the more recently evolved area of the front brain, makes him remember past experience and be conscious of the present in so far as it differs from the past, and to foresee the future in terms of the past. The lower animals have the beginnings of this intelligence, but even in the apes it is rudimentary compared with that which we find in man. Consciousness depends upon change; the greater and more rapid the change in the stimuli that affect us, the more are we conscious of them, and if there is no change there is no consciousness. If our surroundings do not change, our reactions become stereotyped and habitual and unconscious: our balance becomes perfect. Let those conditions alter and our habitual reactions are no longer efficient before them, a new behaviour is necessary, and, if we are to survive, will be developed in time, but it takes time; and when the old and new behaviours overlap each other we vacillate and worry. Worry is only possible when there is a problem that has to be solved, a decision to be taken: it depends on the ability to see two sides, and the more intelligent we are the more possible this worry becomes.

We have to devise complicated experiments to show anxiety at all clearly in the lower animals. These experiments are of extreme interest because it is only with the help of their simpler mechanisms that our problem "what is anxiety?" can be simplified. The best example is the circle-oval experiment of Pavlov. A dog, guarded as carefully as possible from all extraneous stimuli, is shown a perfect circle on a wall in front of it and immediately given food. This is repeated until the dog begins to slobber as soon as it sees the circle—then it is shown an elongated oval. As this is shown in the same circumstances that before accompanied the showing of the circle the dog again slobbers, but not so much. No food follows the oval. The circle is again shown, and the dog again slobbers, but not fully. In subjective language, it has been discouraged. Food is given to it; and the next time the circle is shown it slobbers to perfection. Food is again given. The elongated oval is now shown and the dog slobbers less. No food follows this. After several repetitions the dog will always slobber when it sees a circle and never when it sees an oval. Now a new oval, one that is a little fatter than the first, is shown to the dog, which after slobbering slightly will rapidly become immune if no food is forthcoming. Then the oval is fattened a little more, with the same result. Fatter and fatter ovals are shown. Every time the circle is shown the dog gets food, every time the oval is shown the dog gets no food. Though the oval is *gradually* made more circular something *suddenly* happens to the dog, it suddenly goes mad; it suddenly behaves in a surprisingly unco-ordinated fashion. It barks and runs about and will bite those whom before it accepted as its friends. It will be very difficult to calm again. It may never recover and remain a lunatic. Some of these dogs will improve and perhaps get quite well, but will relapse when again shown the circular oval. Most dogs can be made mad in this way, when the main diameters of the oval have a difference of less than 10 per cent., but some break down earlier and some a little later. Every intelligent dog, that is every dog that has sufficient well-developed sense organs to see the circle and enjoy its food and sufficient memory to connect the two experiences, can be made to go mad in this way. Some breeds of dog reach the breaking-point more suddenly and with worse effects than others. These are the excitable, keen, nervous dogs. When two opposing behaviours are demanded at the same time the result is acute anxiety.

Recently there has been a plethora of psychological schools striving to explain the action of the mind by forcing it to fit every conceivable theory. Psychologists have ceased to be concerned with the slow investigation of the anatomy and physiology of the brain and have irresponsibly postulated not only the soul and will, but have invented every kind of attribute for them—complexes, fixations, repressions, libidos. Let us cut out all this and consider what a man's brain actually is: it is a mass of nerve-cells and fibres whose function is to link up the behaviour of one part of his mechanism with that of all other parts. Its cells can be affected both by each other and by the nerves that come to them from every organ, and also by the chemicals of the blood and lymph

* Passages reproduced, with permission, from "Anxiety and its Treatment, with special reference to Alcoholism," by J. Yerbury Dent. London: John Murray. (3s. 6d. net.) These passages are selected because they appear to convey, in language readily intelligible to the ordinary professional reader, a possible explanation of the neuromuscular derangements in such symptom-complexes as the now widely prevalent "canine hysteria."

that bathe them. Evolutionarily the nervous system began as a network of elongated cells enmeshing the whole body; later we find these cells clumped together in ganglia and the fibres in nerves which collect in a main trunk along the back of the animal—the spinal cord. As the front end of the animal receives more impacts than the back end, sensory organs, especially those of smell, taste, sight, hearing and balance are most developed at the front. The spinal cord therefore became greatly thickened at its front end and this thickening is what is known as the brain. The front part of this brain became progressively larger and larger and the connections made in it by past experience constitute the structure of memory and intelligence. When a nerve impulse comes to it, it enters a maze of fibres, where it may travel for a considerable time before it finds its way out again. The back part of the brain, where it joins the undifferentiated spinal cord, regulates the fundamental processes of the individual; the rate and force of the heart-beat, the rate and depth of the breathing, the percentage of sugar and other substances in the blood, the temperature, sweating, vomiting and defaecation. Very small damage to the back brain causes death, whereas lumps up to an ounce or two can be removed from the front brain, often without very obvious effects, but slight diffuse damage to the front brain will produce hallucinations and various lunacies. There is a polarity between the front and the back brains; this means that when one is more active the other is less active.

The back brain's job is to act, or rather to react to stimuli, the front brain holds up this reaction while the nervous impulse is travelling through all the connections that have been made by past experiences in it. The more varied these experiences the longer will the stimulus take to reach the muscles and glands and to produce responses. It may take so long that a new stimulus affects the animal before the first has been responded to. The front brain acts as a brake on the back brain. The front brain says "No," the back brain says "Yes." The back brain says "Leap," the front brain says "Look before you leap. Remember what mother told you. Remember how you once barked your shin. Remember this, remember that. Think what will happen afterwards. Think of your dependants. Think what a fool you will look. Think of your banking account." The more sides of the question there are to consider the longer you will hesitate before you leap. This delay is the function of the front brain. Even a frog leaps more quickly and a little farther in response to an equal stimulus when it has had its front brain cut away. The centre of restraint is therefore the front brain, whose action produces caution and whose over-action anxiety. The back brain of man is very like the back brains of lower animals. We can call it his animal brain. His front brain is very different from the front brain of any other animal, for though even such a lowly creature as the frog has, as we have seen, the rudiments of it, it is vastly more developed in man. It is the organ that gives him his humanity. It is his one great structural advance beyond all other living things and we can call it his human brain. A man who is considered well balanced has a satisfactory balance between his animal and human brains. Some of us have less, or less sensitive front brains than others. He that has little brain can make up his mind quickly. The less the intelligence the quicker the answer and less likely is that answer to be correct. On the other hand a man may see so many different aspects of a question and he may be so critical of any reply that he never answers at all. He is so far advanced above the lower animals that he is all too human and to do anything he has to dull his humanity, to drug his human front brain. . . .

In infancy when the body is stimulated in any way the whole of its mechanism becomes active. There is an explosion of behaviour but only a few responses are efficient in removing the stimulus. The body reacts blindly until one factor of this blunderbuss behaviour removes the stimulus. The animal then ceases to react but is left with its mechanism in the position it was in when that stimulus ceased: in the position that removed it: and when that stimulus is repeated the reaction is quicker in removing it a second time. If a reaction does not remove the stimulus, then that reaction is continued until tired out, and therefore to some extent damaged, and is less likely to be the response to that stimulus in future. These are the mechanics of natural selection in reactions, and there is a survival of the fittest in our reactions during our individual lives just as there is a survival of the fittest in our structure in the evolution of the race. There is a vast weeding out of inefficient behaviour just as there has been the extinction of millions of unfit species. Education and the development of ability depend on the repression or elimination of unnecessary, awkward or hampering behaviour and the encouragement by constant repetition of the neatest, easiest, the most graceful behaviour. The origin of species does not depend on a special creation for each species but on an evolution brought about by variation and by the elimination of the unfit. This is no more than to say that those that can't survive don't survive, yet this seemed a strange concept in 1859. Natural selection did away with the necessity for design in evolution. Our environment moulds the development of our behaviour and morals by the elimination of all those reactions, or factors of behaviour, that do not fit that environment. We can now understand the development of all our various behaviours without the necessity of postulating a willed direction. As our surroundings are always changing we never quite fit them: we have a behaviour that always lags behind the present necessity. We are fitted to the past more than the present, and the quicker our surroundings change the more ill-fitting will our behaviour be.

With frequent repetition of any stimulus the response grows ever more efficient until a habitual reflex occurs that may remove the stimulus before we have been consciously aware of it. We are always adjusting ourselves to our environment and are only conscious when our reactions are not quite perfect. When no reactions have been built up, that is when some change occurs that is sudden or great or new, we become acutely conscious and our behaviour is unco-ordinated and, even to the firmest believers in reason, obviously irrational. We find ourselves behaving like children: sometimes like very young children indeed.

When a completely satisfactory reaction has been developed to any stimulus we are unconscious both of our reaction and of the stimulus. When a usual stimulus is slightly varied, that is, includes a new factor, the efficient response is a compromise one and we are conscious of our behaviour. If the factors of the stimulus require very different responses, a compromise is impossible; our behaviour may alternate and we are in a state of worry, of fear, of anxiety.

Life is the reaction to stimuli, to the impact of our surroundings. It is the maintenance of balance in a

changing world. All our actions are reactions imposed upon us by our environment and our behaviour is an automatic resistance to stimuli just as a fish's movements are directed against the current in which it swims. The human machine is a mechanism that responds or reacts to three main environments or groups of stimuli. These are the external, the internal and the conversational. The external group acts through the external sense organs, namely the familiar five and others, including those of temperature, position, gravity and electric currents, and affects in the main the external muscles that move the limbs and other joints. The stimuli of the internal environment are those caused by alterations in the chemical composition of the blood, and especially affect the glands of the digestive and excretory systems and the internal, involuntary muscles, and produce a different kind of sensation from that produced by the external environment—a sensation that is called "emotion." The conversational environment is one of symbols for both external and internal stimuli and affects both our external and our internal mechanisms. Though present to some extent in nearly all air-breathing vertebrates, this is fully developed only in man.

When our external senses are acutely stimulated we suffer from pain and this pain may be so great that it causes vomiting. When our internal mechanism is disordered our emotion becomes acute and again we may vomit. The word anxiety comes from the Latin *angere*. It is the same word as angina. Its root means a lump in the throat, a choking. The following words also come from the same root, anguish, anger, awe, ugly and even quinsy.*

A worried person, an anxious person, anyone who is frightened or strongly emotional, suffers from disordered action of the digestive tract. We are not using mere figures of speech when we say that a miserable man is hypochondriac, or that the gorge of an angry man rises and he is bilious with rage. A poet is not using any poetic licence but stating a definite physiological fact when he says his lovers are "love sick." The Bible rightly makes our bellies the seat of our emotions. Our bowels are compassionate and they do yearn. Laughter and weeping are very similar behaviours, they both produce tears and the muscles employed in each are the same as those that produce vomiting. We cry until we are sick; we laugh until we are sick, and our first laugh is a puke. We can be sick with fatigue and sick with excitement, sick with pain. Sickness is the natural effect of anxiety. It is our ultimate reaction towards it. It is our relief from it. Tears relieve us in our sudden grief, vomiting relieves us far more. The commonest hysterical fear is that of choking; it is called "globus hystericus," a lump in the throat, and a lump in the throat is anxiety itself.

Our stronger feelings are not intellectual, they are visceral. Fear stops our digestion and our sensations of fear are to a large extent the sensations caused by the undigested contents of our stomachs. I have seen a man at an operation vomit, unchanged, food that he had swallowed two or three days previously: food that he had taken just before hearing that he had to be operated upon. No one should be told bad news directly after a meal. It should be reserved, if possible, until his stomach is empty. Undigested food causes many of our sensations of anxiety and fear, and these can be relieved by an emetic. When the future is uncertain we cannot prepare for it, or we try to make preparations which will be suitable for all possible futures. We try to do several things at once. In this book I am using the word "anxiety" to include both worry about what may happen and ineptitude if it does. A man who is anxious about the future is always to some extent maladjusted to the present. Anxiety depends upon sudden change. It is an acute consciousness, for consciousness itself depends upon change. If it were possible to live in an absolutely unchanging world consciousness would be nil. . . .

The word "hysteria" has been very much abused by the laity, who think it means wilful bad behaviour to solicit sympathy. It is even used by doctors themselves in this slipshod way. I have read in a medical book that the difference between a real epileptic fit and a hysterical one lies in the fact that the real epileptic damages himself while the hysteric damages other people. A hysterical person is not always a pampered person and he seldom gains anything by his irrational behaviour. When he does, he may deliberately continue that behaviour for its satisfactory results: what started as hysteria may be continued as blackmail. The clinical definition of hysteria is the following, "A functional disability out of proportion to the structural defect." A man may bruise his arm and he may be so frightened that he has irreparably injured it that it becomes paralysed. This is all the more likely to happen if the man has dependants, and the whole of his and their future happiness depends on his health and use of that arm. Fear is a much more potent producer of hysterical symptoms than any hope of sympathy. . . .

When two stimuli* act at the same time they are always connected and each is liable to produce the behaviour originally produced by one acting alone. This phenomenon was very fully worked out by Pavlov, who described it under the term "conditioned reflex." A simple example from every-day life is the following: the smell of food makes our mouths water and our stomachs secrete in readiness for that food. After the smell of food has been accompanied many times by the ringing of a dinner bell, this by itself without any accompanying smell, will produce the same result. We can say that the bell has become symbolic of the smell. The whole of our behaviour to stimuli is tangled up with previous conditioning in this way. Many natural reactions (unconditioned reflexes) have been connected with taboos. A dog may be prevented from eating until its master has said "Paid for." Such a dog may become so well behaved that it does not eat until permission is given. Its digestive juices may not flow until they are permitted, and short of this perfection, if it eats it eats

* A contraction of Squinancy—literally a dog throttling (Skeat).

* Of comparative interest is the following passage from Andrews's description of Matricaria poisoning in cattle in South Africa (Steyn, D. G., 1934, The Toxicology of Plants in South Africa, p. 433): ". . . It is of interest to note that, as has been shown by the work of Sherrington, Graham Brown, and Forbes, 'when the intensities of the two opposing influences on the same centre are nearly equally matched, a rhythmic discharge results' (Bayliss, 'Principles of General Physiology,' second edition, p. 498).

"The occurrence in Matricaria intoxication of exaggerated and diffuse responses to simple stimulation, and of muscular inco-ordination, suggests that in this condition there is disturbance of the normal mechanisms of inhibition, and it is probable that some centres are subjected to the simultaneous action of antagonistic stimuli which normally would not be of sufficient intensity to reach the centre at all. . . ."

THE VETERINARY RECORD

December 6th, 1941.

# THE PHYSIOLOGY AND DISORDERS OF THE NERVOUS SYSTEM IN ANIMALS

IN veterinary medicine, diseases of the nervous system do not loom so large as in human medicine, where neurology and the newer science of psychopathology form major branches of study, claiming the whole-time attention of numerous specialists. Diseases of the digestive and reproductive systems are far more prominent, so far as concern farm livestock. Underlying their proper understanding, a knowledge of the special physiology of each species is essential. We contend that research directed towards advancing knowledge in these special studies has been sadly neglected at the British veterinary colleges. Probably, having regard to the fact that physiology at the veterinary colleges has usually been taught by part-time teachers who have also taught at medical institutions, the physiology of the nervous system has not been allocated a disproportionately large amount of time in the teaching of the veterinary student. It is undoubted, however, that not enough attention has been paid to relate it to the disturbances of this system which are actually encountered in veterinary medicine.

To-day we know that certain grave and widespread disorders, such as louping-ill in sheep and encephalomyelitis in horses (of which *kumri* in India possibly represents the after-effects of a subacute attack) are caused by invasion of the body with viruses which have a specific affinity for the nervous system. No less grave and widespread nervous disorders of milch cattle, such as parturient paresis (milk fever), lactation (grass) tetany, transit tetany and acetonaemia, appear to have their origin in disturbances to the delicately poised organisation represented by the interrelationships of the endocrine "orchestra," autonomic nervous system, carbohydrate metabolism, and mineral balance of the body, which is in a state of very labile equilibrium in these animals. The problem of poisonous plants and other foods likely to give rise to nervous disturbances is of special importance in animals, and as Steyn has it, plant poisoning is more serious than any other disease in South Africa. Certain vitamin deficiencies are also now known to have a profound effect in the nervous system.

We need only mention conditions such as "shivering" and "stringhalt" in horses, the origin of which has remained mysterious, despite the traditional belief that they are hereditary, the more modern tendency in some quarters being to ascribe them to some dietary deficiency, possibly afflicting the subject during foetal life. The problem of canine hysteria is one that has of recent years assumed very great importance, especially since the major disease of dogs namely, distemper, no longer represents so baffling a problem. It cannot be said that the aetiology of the canine hysterias has yet been satisfactorily elucidated, although the evidence seems to suggest that it is caused partly by some dietary errors or deficiencies. The literature on this subject stands in need of careful analysis, for there is an abundance of it already on record. As one correspondent in this journal recently said, the dog is an animal which is in a state of delicate nervous equilibrium. The fourth paper in this issue, in the form of a series of passages which lead up to an understanding of the meaning of the term "hysteria," from an elementary book on the anxiety neuroses, has been reproduced mainly to indicate some of the experimental evidence which lends support to that view. It is clear that a large field of work here awaits exploration, which will be of interest not only directly to veterinary medicine but also to the whole field of comparative neurology and psychology. The authors of the book under review have performed a service the value of which cannot be over-estimated, in indicating clearly the means of investigation available to the veterinary student and practitioner.

For promoting interest in this country in the subject of animal neuropathology* the studies of our colleague, Dr. J. R. M. Innes, are praiseworthy; his own investigations into cerebellar disease in calves, swayback in lambs, and canine encephalitis have added materially to our knowledge upon these diseases.

We are glad to learn that the distinguished author of the first paper in the connected series reproduced in this issue, Sir Joseph Barcroft (who was a member of the Loveday Committee and, therefore, is acquainted with the problem of veterinary education) has recently been appointed by the

(*Concluded at foot of col.* 1, *page* 724.)

without relish and with what can be described as an uneasy conscience. We see the beginning of morality and the anxiety suffered by those who flout general taboos. [Another interesting example (quoted from Steyn, D. G., 1934, The Toxicology of Plants in South Africa, p. 42), of "conditioned reflexes" is the following: "Pavlov and Keylow conducted some most interesting experiments upon dogs with apomorphine and morphine. Dogs were given small amounts of apomorphine subcutaneously and at the time of injection a note of a certain pitch was sounded. After having repeated these injections several times, salivation and vomiting could be produced by the sound of the note alone. After dogs had received morphine injections on several days, salivation, nausea, vomiting, and profound sleep could be caused by allowing them only to watch the preparation for the injection. Such morphine-treated dogs sometimes exhibited symptoms of morphine poisoning when seeing the experimenter or after the injection of a harmless fluid."] J. T. E.

* An address on this subject was given by him before the Lancashire Veterinary Association on October 29th last.

## CLINICAL COMMUNICATION

### An Unexpected Casualty

G. K. BUCKLER, M.R.C.V.S.,
Stevenage, Herts.

*Subject.*—Bay farm gelding, aged 12 to 14 years.

*History.*—Early one evening I received an urgent message to visit a gelding which appeared to be "in a bad way." The animal had been grazing normally when it was seen to be suddenly startled. After trotting a short distance, it stumbled and fell. The horse regained its feet with difficulty, when the owner noticed that it was very distressed and sweating badly. After a short time it managed to walk back to the farm, but appeared to be in great pain. The farm happened to be in an area where the Army was carrying out large-scale exercises and the owner thought the animal had been startled by gunfire, which caused it to stumble and hurt its back.

*Symptoms.*—When seen about an hour later, the animal was still sweating and, when made to move, staggered and almost fell. Any attempt to turn caused the hindquarters to sway in an alarming manner. Respirations were quick, the temperature was 101°, and the pulse rapid. Rectal examination failed to reveal any serious injury of the pelvis. After a careful examination a small punctured wound was found in the region of the off-side shoulder at a point just in front of the centre of the spine of the scapula. The wound was not deep and there had been very little bleeding from it.

*Diagnosis.*—The wound appeared to have been made either by some small sharp object, or possibly a pellet or small bullet. Whatever had caused the wound must have startled the animal, and possibly, when it stumbled it had twisted its back. The only other possible cause of the alarming symptoms was that a small bullet had penetrated the shoulder region and lodged near the spine, causing local pressure there. A guarded prognosis was given.

*Treatment and Course.*—In order to relieve the pain an injection of Novalgin (Bayer) was given, and the animal was rugged up and left in a covered yard. The horse was seen three days later, when it was found to be feeding well but could only move with difficulty and still swayed badly behind. The temperature was normal and the animal was no longer sweating. Faeces had been passed each day, but the animal had great difficulty in urinating. According to the owner, the animal appeared to be in great pain when it was down, and help was needed to get it on its feet.

During the following week the animal remained much about the same, although at the end of that time it could get up on its own and was able to walk slowly round the yard. There seemed no doubt that the back had been injured, and the outlook was not very hopeful. Five days later the owner rang up to say that a small swelling had developed on the near-side shoulder, and that the horse seemed to be walking much better. The swelling was well fomented twice daily and, when seen two days later, was about the size of a hen-egg and situated approximately one inch in front of the scapula. It was soft and painless and appeared to have a hard core. When the swelling was lanced the "core" turned out to be a ·303 rifle bullet. The horse was now walking well and the swaying in the hindquarters had almost disappeared. It now looked as if the animal would make an uneventful recovery.

Remarks.—From the history of the case and the symptoms observed, it now seems possible that the bullet passed just in front of the off-side shoulder blade and lodged in the region of the first or second dorsal vertebra. It may have struck one of the vertebrae and caused some slight injury to the spinal cord. By a fortunate chance it must have worked its way under the vertebrae or possibly between the supraspinous processes of the anterior dorsal vertebrae. It is interesting to note that the sudden improvement in the animal's condition coincided with the appearance of the swelling in front of the other shoulder-blade. From the position of the original wound and that of the swelling, it seems that the bullet must have passed in a practically straight line through the base of the neck, in which case the animal had a very lucky escape. The source of the bullet remains a mystery!

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Agricultural Research Council to the charge of a new unit of animal physiology at Cambridge, closely linked with the Institute of Animal Pathology, wherein, we understand, will be carried out mainly investigations into the physiology of the farm animals. It may not be out of place to enquire why such work has not been undertaken long ago at the veterinary colleges. We can wish Sir Joseph Barcroft well in his new enterprise and feel assured that not only will there be a wealth of new knowledge forthcoming from the activities of the unit directed by him but also that a number of experienced young research workers will be trained there who will be available to occupy teaching and research posts at the veterinary colleges and other veterinary institutions.

## ABSTRACTS

[**FAT EMBOLISM AND THE BRAIN.** Disc. Sect. Neurology, Roy. Soc. Med. (1941.) *Proc. Roy. Soc. Med.* **34**. No. 10.]

Robb-Smith defined fat embolism as a condition in which there is fat circulating in the blood stream in globules sufficiently large to occlude the capillaries and induce multiple anoxaemic foci. The condition is most frequently associated with trauma, particularly in cases of multiple fractures of the long bones or the skull, but may also occur following severe burns, manipulations, therapeutic injection of oily solutions and as a complication in poisoning by ammonia or other alkalis. Authorities disagree in regard to the source of the fat; some consider the condition results from fat from the bone marrow being forced into veins of the medullary cavity at the moment of impact, or from the slow seepage by vein or lymphatics of extracellular fat around the fracture; others have suggested that substances enter the blood stream and change the physical state of the plasma lipoids or lipo-proteins. Fat embolism can be induced in animals by local trauma or centrifugalisation. The clinical picture varies according to whether the fat is held up in the lungs or forms emboli in the heart, brain, etc. Clinical description was given of cases of fat embolism of the

lungs and of the associated *post-mortem* and histological findings. The value of blood and urine examination is a matter of dispute. Fat can be found in the urine in clinical cases and the kidneys may show fat in the glomeruli. Observations were made on the mode of treatment. Prophylactic treatment is as for first-aid —complete immobilisation of the fracture. The value of oxygen treatment, phlebotomy and blood transfusion is discussed. Drugs appear to be of little service. The diagnosis of mild cases is difficult, while the vast majority of severe cases end fatally.

HUNT stated that the significance of fat embolism is undetermined and in a consideration of the complications of trauma its place must be considered carefully. The clinical symptoms in systemic or cerebral fat embolism are most characteristic, in contrast to the pulmonary type. A typical case report is given.

GREENFIELD gave a full account of the examination of a brain with fat embolism. Macroscopic examination showed petechial haemorrhages in the white matter, being the chief or only abnormalities present in such brains, although microscopic study showed that ischaemic degeneration of neurones and myelin is of much more importance in the production of symptoms.

Subsequent speakers made observations and asked questions on the preceding points. A. E.

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**[TUBERCULOSIS OF THE STOMACH AND GASTRIC LYMPH NODES IN THE PIG.** KELLER, H. (1940.) *Z. Fleisch- u. Milchhyg.* **50**. 221-224.]

Tuberculosis of the stomach in the pig is extremely rare, although lesions in the gastric lymph nodes are fairly common. Keller has examined about 1,000 stomachs of tuberculous pigs and has encountered only one case of gastric tuberculosis. The lesions were confined to the serosa and muscularis near the pylorus, the mucosa being normal.

The gastric lymph nodes drain lymph not only from the stomach but also from the thoracic oesophagus, diaphragm and pancreas. Tuberculosis in these sites is one explanation of infection of the gastric nodes. In addition, tuberculous lesions in the coeliac lymph nodes may extend to the gastric nodes with which there are numerous anastomoses between lymph vessels. Similar anastomoses exist between the gastric and the portal, splenic and pancreatic nodes.

The author concludes that the German meat inspection regulations should be altered so that the stomach is not of necessity condemned merely because of tuberculosis of the gastric lymph nodes.

E G. W.

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**[BEE STINGS IN HORSES.** DAAKE. *Deuts. tierärztl. Wschr.* (1940.) **48**. 21-24.]

A number of cases of bee stings in horses has been recorded; they have usually proved fatal. The author describes the devastating effect of a swarm on four army horses drawing a wagon which pulled up near a camouflaged bee hive in a young pine plantation. The animals were sweating and it is suggested that this attracted the bees, which attacked both horses and men. The horses became frantic and three of them died within a few minutes. The fourth was rescued but died four hours later in spite of prompt treatment with digitalis and cardiazol. There were bee stings all over the body and an area of skin of one square centimetre showed 60 stings. The animal showed a staggering gait, raised body temperature, accelerated pulse and respiration, and extremely painful swellings over almost the whole skin surface. The findings at autopsy included pulmonary congestion, cardiac dilatation, intravascular haemolysis and oedema of the glottis, as well as sero-haemorrhagic infiltration of the skin and subcutaneous tissues. E. G. W.

## IN PARLIAMENT

The following are among the questions and answers recently recorded in the House of Commons:—

### Dairy Cattle (Inspection)

Mr. PRICE asked the Minister of Agriculture what steps have been taken to set up a scheme for the regular inspection of dairy cattle by voluntary arrangements with farmers for the elimination of contagious abortion, mastitis and Johne's disease; and for the provision of serum at special rates for this purpose?

Mr. HUDSON: The arrangements for a voluntary scheme for the control of certain of the major diseases of dairy cattle are in an advanced stage of preparation, but difficulties in connection with the choice of the most suitable contagious abortion vaccine have somewhat delayed its inception. I hope, however, that this difficulty will shortly be resolved.

Mr. PRICE: While thanking the right hon. Gentleman for the answer he has given on this important matter, can he say whether the number of qualified veterinary surgeons is sufficient, in his view, to get this scheme administered?

Mr. HUDSON: That is a matter of opinion. I should like to have notice of that Question before expressing any opinion.

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### Tuberculin Tests

Major LLOYD asked the Minister of Agriculture whether, in view of the experience of Scottish and English herd owners with the Weybridge tuberculin test and the lack of confidence felt in the test by the industry, he will consider discontinuing the use of the recently introduced tuberculin and reverting to the type of preparation formerly used pending further scientific investigation; and whether he will consider the advisability of arranging a conference between representatives of Scottish and English herd interests and veterinary medical associations to discuss this matter in the light of their respective experiences?

Mr. HUDSON: The whole question of tuberculin and the tuberculin test has for some time been under investigation by the Joint Tuberculosis Committee of the Agricultural Research Council and the Medical Research Council, and I propose to await the findings of that Committee before taking any fresh step in the matter.

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HILL SHEEP FARMING (SCOTLAND) (SPECIAL SUBSIDY)

Mr. SNADDEN asked the Secretary of State for Scotland if he is now in a position to announce the scale of assistance he proposes to give to the hill sheep industry?

Major MCCALLUM asked the Secretary of State for Scotland whether he is now in a position to make any statement regarding the proposed form of compensation to hill sheep farmers for the heavy losses in sheep and lambs suffered by them due to the severe winter of 1940-41?

THE SECRETARY OF STATE FOR SCOTLAND (Mr. T. JOHNSTON): Yes, Sir. I have been making a careful examination in consultation with my right hon. Friend

the Minister of Agriculture of the economic position of the hill sheep farmer during the past year. The difficulties facing the hill farmer in this period have in most cases been such as to make his position worse than in 1940, despite the improvement in prices at the autumn sales. The preservation of foundation breeding stocks of hill sheep and the maintenance of hill grazings in food production to the maximum extent are of prime importance, and it is necessary that this branch of farming should be encouraged to carry on in good heart, and with renewed confidence. Taking into account all relevant factors, the Government have decided that a special subsidy should again be paid on the same general lines as last year. In view of the exceptional circumstances of the past season, the rate of subsidy on this occasion will be 7s. 6d. for each eligible breeding ewe and shearling, and payment will be based on the number of sheep in flocks on December 4th, 1940. Full details will be published at an early date.

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### Horseflesh

Lieut.-Commander Tufnell asked the Parliamentary Secretary to the Ministry of Food whether horseflesh for animal and human consumption, respectively, can both be sold in the same shop?

Major Lloyd George: The answer is in the negative, the Horseflesh (Control and Maximum Prices) Order, 1941, which came into operation on November 24th, 1941, prohibits from that date the sale of horseflesh for human consumption at any premises where meat other than horseflesh is sold for that purpose or where horseflesh not fit for human consumption is sold.

Lieut.-Commander Tufnell asked the Parliamentary Secretary to the Ministry of Food the reason for the delay in reaching a decision as to the fixing of two different prices for horseflesh according as it sold for human or animal consumption?

Major Lloyd George: I would refer my hon. Friend to the reply which I gave on November 19th to the hon. Members for Twickenham (Mr. Keeling) and Doncaster (Mr. E. Walkden). An order prescribing maximum prices for horseflesh sold for human consumption came into operation on November 24th.

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### Horse (War) Transport (Organisation)

Mr. W. P. Greene asked the Secretary of State for War whether, following upon a reply given by the then Financial Secretary to the War Office on the subject of horse-drawn transport on May 4th, 1939, the right hon. Gentleman can state what special steps have been taken in this regard?

Colonel Llewellin: I have been asked to reply. It has not been found necessary to take any special steps in regard to the organisation of horse transport.

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### Hunters (Training)

Sir Waldron Smithers asked the Minister of Agriculture (1) how many mares, geldings and horses there are in training under National Hunt Rules for which rations have been granted; (2) whether he will take steps to secure from Messrs. Weatherby a monthly return of the number of horses in training under National Hunt Rules?

Mr. Hudson: A monthly return of horses in training under National Hunt Rules is already furnished to my Department by Messrs. Weatherby, and this constitutes the basis on which rations are allowed. The numbers rationed for November were 100 mares, 525 geldings and 102 horses.

Sir W. Smithers: In view of the paramount need of maintaining the milk supply, is it necessary to issue rations to these mares and geldings, rations which might, and should, be used for the further production of milk?

Mr. Hudson: As I have explained on numerous occasions, the total amount consumed by these horses is negligible in relation to our total supplies.

# NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

### Diary of Events

Dec. 6th.—First General Meeting of the Society of Women Veterinary Surgeons, at 36, Gordon Square, W.C.1, 1.30 p.m.

Dec. 12th.—Meeting of the North of England Division, N.V.M.A., at Newcastle-upon-Tyne, 2 p.m.

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### R.C.V.S. OBITUARY

Macfarlane, Archibald McLean, Zetland House, Aberchirder, Banff. Graduated N. Edinburgh, December 19th, 1902. Died (suddenly at his home) November 19th, 1941.

Senior, John William, Grove End House, Wem, Salop. Graduated London, May 17th, 1895. Died November 21st, 1941, aged 69 years.

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### PERSONAL

*Marriage.*—Dunn—McLaughlin.—At Glasgow, on November 13th, 1941, J. Drummond Dunn, M.R.C.V.S., Rutherglen, son of Mr. Geo. D. Dunn and the late Mrs. Helen Dunn, Bearsden, to Evelyn Frances, daughter of Mr. and Mrs. J. A. McLaughlin, "Domira," Partickhill, Glasgow.

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### PROTECTIVE CLOTHING FOR VETERINARY SURGEONS

The Board of Trade has informed the Association, in response to a "reminder" letter concerning N.V.M.A. representations that protective clothing for veterinary surgeons should be obtainable coupon free, that the matter is still under discussion with the Ministry of Agriculture and Fisheries. The Board's communication also informs the Association, in response to an enquiry on the point, that "at the moment the Executive Officer of a County War Agricultural Committee is not empowered to give certificates."

A recently issued Press notice (B. 131) indicates that a wide range of utility coat overalls now require fewer coupons. In its course the notice states: "The provisional arrangements made when rationing began to ensure that workers should not have to go without essential overalls, have resulted in some unfairness. Some industrial overalls, such as boiler suits, have been coupon-free, while others required seven coupons. . . . In future all industrial overalls will be available at 2, 3 or 4 coupons each, according to type. Overalls which till now have been coupon-free will in future be subject to the following coupon rating:—

| | | |
|---|---|---|
| Boiler Suits ... ..... ... ... | 4 | Coupons. |
| Bib and Brace Overalls ... ... | 3 | " |
| Overall Trousers ... ... ... | 2 | " |

"The reduced coupon pointing for other types of 'Industrial' overalls is given below:—

| | | |
|---|---|---|
| Overall Long Coats ... ... | 3 | Coupons. |
| Wrap Over Coats ... ... | 3 | " |
| Overall Jackets ... ... ... | 2 | " |
| Aprons ... ... ... ... | 2 | " |

"To qualify as an 'Industrial' overall the garment must be unlined and made of plain or twill weave cotton material in plain single colour.

"After the end of January, 1942, these pointings will apply to overalls only when they are made from utility cloth No. 311: those made from other material will carry a higher pointing.

"The maximum prices of these garments will be fixed in an order to be made by the Board of Trade after consultation with the Central Price Regulation Committee.

"The permission for various inspectors to certify the coupon-free supply of overalls will now be with-

drawn. This fits in with the Board of Trade's general plan to bring to an end the temporary arrangements for the signing of documents, and their use as substitutes for coupons."

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## MINISTER ON THE NEW POLICY FOR AGRICULTURE

"Look to the Land" was the subject discussed at a Foyle luncheon at Grosvenor House on November 27th. The speakers welcomed the recent increase of the agricultural labourer's wage and emphasised the importance of a prosperous countryside.

Mr. R. S. Hudson, Minister of Agriculture, who presided, said the demand of the town workers for cheap food had made it impossible for the farm labourer to earn a decent wage or the farmer to earn a decent profit out of which to live and finance his industry. Not only had the labourers and the employers been sweated, but the land also had been sweated and its fertility diminished. It must be restored to its proper place in the national economy. To-day a beginning had been made. With the increase in the labourer's wage would go higher returns to the farmer. The consumers and taxpayers would have to pay for that. But it might not cost very much if they undertook to see that the costs of distribution were ruthlessly cut down.

The money being spent to-day in reclaiming derelict land and putting it back into good heart was a sound investment for ourselves and for generations to come. Our heritage of agricultural knowledge and skill was one of our greatest national assets. Ruin faced European agriculture to-day under the Nazi heel. It would take years before recovery could take place after the war, and we in this country must rely not only now, but after, on our own resources for a large part of our food supplies.

Lord Addison referred to the neglect of the industry after the last war, which he described as the greatest industrial betrayal in our history and said that the only way to prevent a repetition of that error was by agreement among ourselves.

Mr. A. G. Street said the agricultural industry asked for equal treatment with the town industries.

Lord Lymington said there was no opportunity in most villages beyond being a labourer. They had to look forward to a period of opportunity when a man would have a chance to become a master man. There should be not only such opportunity, but also a completeness in village life, with a return of rural industries.

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## MINISTRY OF AGRICULTURE NEWS SERVICE

### The Drama of the Land

*Farmers Begin Their Greatest Undertaking.*—Agriculture has crossed the threshold of another cropping year. The achievements of farmers and farm workers in the first two years of war have been brilliant, but they are now put to the crucial test of reaching an output of food per acre that will break all previous records. With more shipping required for the transport of munitions to every battle zone, less will be available to carry food to our shores. Mr. Hudson has called for a bigger acreage of wheat, for a maximum output of milk and beef, for more sugar beet and more potatoes. Wheat he described as the sheet anchor of the nation in war-time. We must have more—by next harvest.

A year ago it was feared that farmers could not make good in two years the loss of imported concentrates on which our pre-war milk supply was largely based. This fear has dissolved already into a bigger *per capita* consumption of milk than ever before. But, again, we need all we can produce. Nutrition, important in peace, is vital to a people at war. Dairy farming must become more nearly self-sufficient. Every gallon of milk counts now; it will be harder to get, but more necessary as time goes on. A year hence we must also fill our sugar beet factories to capacity. The next acreage of potatoes, too, must be big enough to ensure complete safety. By pre-war standards this programme is colossal; work on the land on the last two years has shown it to be attainable. The drama of war is as vivid and real on the farm as it is in the munitions factory.

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### Feeding Linseed

*Calves Should Be Given Priority.*—The oil and starch content of linseed is higher than that of linseed cake; the protein content is lower. These facts should be borne in mind by farmers who have grown linseed for feeding to livestock this winter. For some animals linseed may in itself be a balanced food, while for calves it is often used as a fat substitute for feeding along with separated milk. Although not quite so high in protein, 1 lb. linseed can replace 1 lb. linseed cake or cake meal for calves, growing and fattening animals. As a substitute for decorticated ground-nut cake, a double quantity would be required.

Linseed is a safe food, though its high oil content makes it somewhat laxative. For economical use it should never be fed whole; it should be either crushed or ground. Under present conditions linseed should be earmarked in the first place for calves under six months, or for dairy cows. It is not suitable for fattening pigs.

It is, of course, a mistake to depend on linseed as the only source of protein for cow feeding. A balanced ration for dairy cows using linseed is 1½ lb. linseed and 2 lb. bran per gallon of milk.

# CORRESPONDENCE

Letters to the Editor should reach the Office not later than by the first post on Monday morning for insertion in following Saturday's issue.

*The views expressed in letters addressed to the Editor represent the personal views of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.*

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## AGRICULTURE AND THE VETERINARY PROFESSION

### To the Editor of the Veterinary Record

Sir,—As one who has from time to time advocated in your columns an enlarged and appropriately remunerated State Veterinary Service comparable to those obtaining in our Colonies, in which every member of the profession might find a place, I have followed with keen interest and regret the controversy concerning the Survey Committee's Report and recommendations.

It would appear that in spite of the self-sacrificing efforts of the Committee, the opportunity adumbrated by our Presidents, past and present, of playing our legitimate part in the present war effort, has been denied us. It was perhaps unfortunate that at a time when we were seeking to inspire confidence the Committee should have laid such emphasis on our inability to control certain diseases concerning which present knowledge is somewhat incomplete, and that the rank and file of the profession should have criticised so loudly the recommendations of their experts. It was surely unnecessary and ill-advised to draw attention to our limitations. No science has yet reached finality and if we have not yet acquired a complete knowledge of all the numerous diseases of animals, it is not entirely our fault but due rather to the shameful neglect of veterinary education and research by politicians in the past. Moreover, ours is not the only profession which still has much to learn: even the medical profession is as ignorant of many of the diseases affecting man and animals as we are. But it does not advertise the fact and its valuable services to the public are not contemptuously rejected.

On the other hand we might have drawn greater

attention to our record of successes in the past, of which we may well be proud, and have insisted with more force that if we were properly organised and permitted to undertake the duties we alone are qualified to perform, we might add to our laurels and prove extremely helpful to agriculture and the general public. We should have pointed out that in addition to the prevention and treatment of disease we could render valuable assistance and advice in the breeding and feeding of stock and in helping to maintain them in a state of good health, and that we could supervise, standardise and regularise the marketing of animals and animal products—the legitimate and recognised function of the veterinary profession in more progressive countries.

It is surprising that the modest request of the veterinary profession to play its part in the national effort should have been received with such scant consideration since the future of the agricultural and pastoral industries of this country is so largely dependent upon the proper application of veterinary science. If agriculture is to survive after the war it must "put its house in order" without delay. Before the war it was unable to produce more than 30 per cent. of the food requirements of this country, and the present increase is largely due to artificial conditions and subsidies. As time goes on and transport facilities improve, overseas supplies will again reach this country in ever-increasing quantities and eventually flood our markets. The danger of starvation having ceased, interest in British agriculture will decline and in all probability the industry will, as after the last war, return to that state of decadence from which it was temporarily rescued by the present emergency. Having welcomed the assistance of the Dominions and Colonies during the war, we cannot close our markets against them in times of peace. In the future as in the past the home-producer will not be able to compete with his friendly rivals from overseas, whose supplies are so regular in quantity and, thanks to veterinary supervision, so uniform and excellent in quality, unless he improves both his methods and his products. It has been suggested by a member of the "Brains Trust" that a system of standardised prices and increased wages may save the situation, and an agricultural writer, recently reviewed in your columns, points out that there will always remain a demand for fresh milk and new-laid eggs. But these learned gentlemen have overlooked the fact that our flocks and herds are constantly depleted by diseases which constitute the chief obstacle to progress and prosperity. Unless these can be controlled the home producer cannot hope to "hold his own" after the war. If the Government hopes to maintain an agricultural population on the land it should without further delay commence to place the pastoral industry upon a sound foundation, that is, a foundation of good health, and to this end the advice and assistance of the veterinary profession is indispensable.

Although one would not disparage the valuable work of the Survey Committee—and having "got our foot in the door" it may be well to keep it there—it must be admitted that its very humble scheme is quite inadequate if the salvation and resuscitation of the agricultural industry is to be achieved. Something far more comprehensive is necessary. And since the conservation of our "premier industry" is the concern of the State, it now remains for the Government to take the initiative and appeal to the veterinary profession for assistance. No longer should it be left to the profession to beg "cap in hand" for permission to perform its legitimate duty, but having offered its services and been rejected, it should with dignity and patience prepare itself for the day when its honourable and onerous task will be allotted to it.

Yours faithfully,

Ll. E. W. Bevan.

Rhodesia House,
429, Strand,
London.

## ERADICATION OF DISEASE

### To the Editor of the Veterinary Record

Sir,—Further to my letter of October 10th, 1941, in the *Record*, under the above heading, it may be of interest to some of my fellow-practitioners to know that the bull referred to has at last found its rightful place—the slaughterhouse—and I have had an opportunity of conducting a *post-mortem* examination.

The submaxillary, bronchial, mediastinal and prescapular glands were found to be very greatly enlarged, and on cutting into them were found to be a mass of calcified material. The mesenteric lymphatic glands were also affected in the same way, some of them being as large as a hen's egg. I am satisfied that there is not the slightest doubt that these glands were tuberculous.

With reference to Mr. Hay's letter in the *Record* of November 8th, 1941, I, in common with other practitioners, have come across scores of such cases, and without exception those upon which I have had an opportunity to conduct a *post-mortem* examination have proved to be tuberculous. I have not so far been able to diagnose lymphadenitis in the bovine. I also consider it doubtful if acid-fast bacilli would often be found in material from an affected gland such as Mr. Hay describes, even if it was affected with tuberculosis.

Further to Mr. Hay's letter, I have always been under the impression that one of the few ways the disease can be inherited is when the sire or dam is affected with tuberculosis of the genital organs.

With regard to the reaction—so very marked and typical—being a non-specific reaction, it would not speak very hopefully for the reliability of the test if such was the case.

Finally, when I advised my client to report the case I had no doubt whatever that the inspector would take him, otherwise I should not have wasted time in giving such advice. As to enhancing the profession in the eyes of the farmer, or encouraging co-operation between the Ministry inspector and the practitioner, it simply did not enter into the matter, and I entirely fail to see what it has to do with the case. Such remarks, in my humble opinion, are apt to sow seeds which were never really there. I advised my client to report the case as I considered it my duty to do so, and I still consider it was my duty in spite of Mr. Hay's remarks—and there, so far as I am concerned, the matter ends.

Yours truly,

Robert E. S. Tuckey.

St. Mary's House,
Whitchurch,
Salop.
*November 29th*, 1941.

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## CONTROL OF DISEASE

### To the Editor of the Veterinary Record

Sir,—I think Mr. John Weir, in his letter of November 29th, has dwelt on one aspect of the control of disease which has been singularly evaded and neglected in recent discussions on the above subject. The *first step* in the control of spreading diseases is to have at hand suitable premises in which to control them. The improvement and modernisation of cow-houses has been by no means thoroughly carried out, although in some districts credit must be given: those who have had experience in the infinite tact, persuasion and exhortation necessary to get owners, etc., of cow-houses to move in this matter will know what I mean. In my view properly planned and constructed shippons, and education and instruction in *good hygiene* are the first effective steps in the control of epidemic and endemic diseases, and if these steps are not taken attempted control of disease is almost labour in vain.

Yours truly,

G. Mayall.

Bolton.